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Inhaled foreign bodies: some complications and errors

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The inhalation of a foreign body is a commonplace accident. Most things that 'go the wrong way' are coughed up, aided perhaps by a slap or punch on the back or, when size allows, by tipping the patient upside down. The majority of foreign bodies that are not recovered in this way are removed through the bronchoscope, easily and uneventfully. The technique of bronchoscopic removal and the difficulties and hazards that may be encountered have been described by many authorities, notably by Jackson and Jackson (1950) and Thomson and Negus (1955). Great expertise has been developed and instruments have been designed to meet almost every eventuality. The morbidity arising from the presence of long-standing intrabronchial foreign bodies has been the subject of a number of papers. Linton (1957) described 16 cases and reviewed the literature. Indeed it may seem superfluous to add to the records or discuss the subject further. Experience suggests that this is not so, and some support is lent to this impression by the figures of deaths from the 'Effects of Foreign Bodies' in the air passages and lungs recorded in the Registrar General's Returns for England and Wales. In 1960 the figure was 443; in 1961 it was 471.

The type of foreign body is not stated in these Returns; no doubt food and vomitus come high in the list, and, as is to be expected, the highest incidence was in the first year of life and accounted for over 40% of deaths. Doubtless, of the remainder, some were terminal events in otherwise fatal conditions, and some probably occurred in circumstances that made it impossible to remove the obstructing agent in time to save the patient's life. However, a number may have been preventable. A breakdown of the figures shows that deaths from the effects of foreign bodies in the bronchi and lungs, as opposed to those due to foreign bodies in the larynx and trachea when death is usually due to asphyxia, were 20 for 1960 and 11 for 1961. These figures are without doubt too low; they tie up with those for morbidity that are unknown for these or any other years; not all cases are reported in the literature, and it is not uncommon for the presence of a foreign body to remain unsuspected as the cause of a patient's illness for years, and it is a reasonable assumption that in a number it remains unsuspected as the cause of death. Death and morbidity in this latter group could generally be prevented by early diagnosis. However, the variety of inhaled objects being legion, this of itself gives rise to difficulties in both diagnosis and treatment. The more unusual circumstances may not occur more than once in the experience of one surgeon, and to be forewarned one has to rely on knowledge of the experience of others. This is the reason for this paper which is a report and discussion of cases in which difficulty arose or which were thought in some way to be unusual. Eight cases are reported and others are referred to in the discussion. In the first four patients the foreign bodies were of long standing; in the other four, the presence of a foreign body had been diagnosed before serious damage had been done; the difficulties were associated with removal.

CASE REPORTS

CASE 1 A boy of 15 years was admitted to hospital with a left streptococcal empyema. There was a history of previous 'chest trouble'. At the age of 9 years he had a left 'pneumonia' for which he had been admitted to another hospital. He made a satisfactory recovery but a year later he had an haemoptysis. Thereafter he remained well until his present illness which began suddenly with fever and pain on breathing. Treatment of the empyema by aspiration and chemotherapy had begun before transfer to the thoracic unit, and the fever and pain had subsided. Clinically and radiologically there was evidence of pulmonary and pleural infection but no foreign body was noted at the time or was visible in retrospect; bronchoscopy revealed a markedly red mucosa in the left lower lobe and purulent secretion. A bronchogram showed bronchiectasis of the left lower lobe. The empyema failed to clear with conservative measures and was later drained, and shortly after it had healed a lobectomy

was done. Recovery was straightforward. Embedded deeply in the lobe was part of a toy soldier's head. Subsequently the parents stated that the boy had 'swallowed' a piece of tin soldier when he was 8 years old, a year before the first attack of 'pneumonia', and had subsequently coughed it up about a year after the haemoptysis. They were able to produce this piece of soldier. No foreign body had been noted in the radiological investigations undertaken during his illness at 9 years of age or after the subsequent haemoptysis. He was not bronchoscoped on either occasion.

CASE 2 A man aged 30 years was admitted to hospital for investigation of a productive cough and pain in the chest. He was found to have a right-sided sterile empyema. A bronchoscopy revealed granulations in the right lower lobe bronchus and a copious purulent secretion. A bronchogram showed gross bronchiectasis of the middle and lower lobes.

Recovery was uneventful after resection of the middle and lower lobes together with the empyema sac.

In a segmental bronchus of the lower lobe a piece of a premolar tooth was found. Subsequently a history was obtained of a dental extraction of several teeth under general anaesthesia about one year previously. Some loose teeth were left to be dealt with later; however, the second operation was not done as one month after the first he developed a 'bad influenza' and had never been really well since.

CASE 3 A woman aged 30 years was admitted to hospital in a confused state and was unable to give a rational history. She was pyrexial and had a cough with copious sputum. It was known however that she had been an epileptic for many years and had received treatment in various hospitals and also that she had about four years previously been investigated in a chest hospital for cough and recurrent respiratory infections. At that time bronchograms were done, and these showed a normal right lung and minimal bronchiectatic changes in part of the left lung. These were not considered severe enough to warrant surgery, and medical measures were prescribed. She was not bronchoscoped.

On admission the radiographs showed complete atelectasis of the left lung. She was treated with antibiotics and postural drainage for a few days and was then bronchoscoped. In the left main bronchus were raspberry-like masses of tissue through which seeped a profuse purulent secretion. In view of the long history it was considered to be probably an adenoma. It should equally have brought to mind the possibility of a foreign body, but it did not. A biopsy was taken which was reported as granulation tissue, but meanwhile a bronchogram had been done and this showed gross bronchiectasis of the whole of the left lung, for which it was considered pneumonectomy was the only treatment. This was carried out and after removal the lung was examined; embedded in the granulations in the left main bronchus was a piece of rubber tubing about 2 cm. long. Presumably some time in the past it had slipped off a mouth gag inserted during one of her epileptic episodes. Post-operatively she developed status epilepticus and acute gastric dilatation; however she survived and thereafter her progress was uneventful.

CASE 4 A child of 3 years was referred to hospital for bronchoscopy having been sent to a chest clinic because of haemoptysis. A radiograph had shown a screw in the right lower lobe. The haemoptysis, described as 'large', had been preceded by slight staining of the sputum for about a month.

At bronchoscopy blood and pus were present in the lower lobe but no screw could be found. A thoracotomy was done. The base of the right lower lobe was airless, felt solid, and was densely adherent to the diaphragm; the condition was obviously of long standing. The screw could not be palpated. A lobectomy was done and the child made a good recovery. The screw was found deeply embedded in the lobe. Subsequently we learned that the child had 'swallowed' something about two years previously and had been wheezy for a few hours, but afterwards she appeared to be well and no action was taken.

CASE 5 A man aged 45 years was chewing a mouthful of peanuts when some went 'the wrong way'. In the following weeks he had two febrile attacks accompanied by pain in the chest. He was given antibiotics and these symptoms abated, but a cough persisted and he had a wheeze on deep inspiration. He was referred for investigation some two months after the accident. A radiograph showed no abnormality. A bronchoscopy was done and a piece of peanut was removed from a right basic bronchus. The rest of the bronchial tree was searched but no more pieces were found. The patient left almost immediately for a pre-arranged visit to the United States of America. His cough persisted but he declined further intervention while in the States. On his return we re-bronchoscoped him. The mucosa was markedly red and pus was present in the right main bronchus. However the outstanding feature was bronchospasm generalized on both sides and evident clinically and bronchoscopically. No more pieces of nut were found. The radiograph showed basal shadowing in the right lower lobe and a bronchogram showed deficient filling in the same area. A thoracotomy was advised. The base of the right lower lobe for about one inch deep was of a deep dark red colour; it felt hard and nodular and could not be inflated. The lobe was removed. On removal of the proximal bronchial clamp for toilet before closure, a piece of peanut was seen and removed. This stimulated a further bronchoscopic examination but no more nut was found. In the lobe removed the nodularity in the consolidated part appeared to be due to inflammatory reactions around minute fragments of peanut. Histological examination supported this interpretation. No more macroscopical fragments were found.

Post-operative recovery was smooth, but the episode had cost him a lobe.

CASE 6 A girl of 4½ years was taken to the doctor because her mother had noticed a persistent wheeze when the child was sleeping. When examined there was no wheeze and the child appeared to be well. However she was sent for a radiographic examination and the film showed what appeared to be a small foreign body in the left lower lobe. At bronchoscopy a small white object could be seen on the medial wall of the left lower lobe bronchus, but attempts to dislodge it were unsuccessful. It appeared to be at the level of or just below the orifice of the apical segmental bronchus of the lower lobe.

A thoracotomy was done and, via a bronchotomy, a piece of sheet metal about 0.5 cm.^{2} was removed from the left lower lobe bronchus just below the orifice of the apical segment. To gain easy access the apical segmental artery was divided.

Convalescence was straightforward and the child was known to be well five years later.

CASE 7 A woman aged 60 years, who had had a left pneumonectomy for tuberculosis seven years previously, was readmitted as an emergency because of breathlessness since something had gone 'the wrong way' at lunch about two hours earlier. She was slightly cyanosed and had a pulse of 80/min. and a respiration rate of 24/min. There was diminished air entry at the right base, and a clicking sound could be heard in mid-inspiration. The radiograph was not helpful.

Under local anaesthesia a bronchoscope was introduced. Some debris and secretions in the trachea were sucked away but this caused distress to the patient who became excited and began to struggle, with a resultant increase in the cyanosis and a weakening of the pulse. The bronchoscope was withdrawn and oxygen was administered via a mask for a few minutes. She became quiet again and then the anaesthetist introduced an endotracheal tube and administered oxygen for some minutes via the tube. She was now calm and her colour was good. The endotracheal tube was withdrawn and the bronchoscope was re-introduced. A number of garden peas and some secretion and debris were removed from near the middle lobe orifice. For some days she had purulent sputum and an evening temperature up to 101° F. A further bronchoscopic examination was made but nothing was found except a red and irritable mucosa. Thereafter she made slow but steady progress with antibiotics and postural drainage.

CASE 8 A male infant aged 19 months was taken to hospital because it was thought that he had inhaled a peanut. Radiographs showed distension of the left lung with displacement of the mediastinum to the right. A bronchoscopy was done under general anaesthesia and a nut was found in the left main bronchus but attempts to remove it were unsuccessful and were finally abandoned because of cardiac arrest. The heart beat was restarted by external cardiac massage but the infant did not regain consciousness. A few days later a second attempt to remove the nut was made by another operating team, but this met with no more success and again the procedure had to be abandoned because of cardiac arrest, and once again the beat was restarted by external cardiac massage. For some days the child's condition was critical, but a tracheotomy had been done and tube feeding was instituted, and slowly his condition improved. When seen some 10 days after the second bronchoscopy the general condition was fairly good but he was still unconscious, though not deeply so; he would for instance cry if another child in the ward started crying.

The radiograph showed distension of the left lung with displacement of the mediastinum to the right with marked encroachment of the right lung field. It was decided to proceed with the removal of the foreign body.

A few drops of local anaesthetic were trickled through the tracheotomy tube and a Negus child's bronchoscope was passed through the stoma. The nut was at about the level of the left upper lobe orifice; it appeared to be impacted in oedematous mucosa and attempts to grasp it and remove it were unsuccessful. One supposes it could have been broken up and removed by suction but previous experience with fragmented peanuts did not encourage enthusiasm for this procedure and it was considered to be wise to remove it intact.

Operation Under general anaesthesia a left thoracotomy was done, positive pressure being avoided until the chest had been opened and the left main bronchus had been isolated and temporarily clamped proximal to the position of the peanut. Thereafter the anaesthesia presented no difficulty, as in fact it had not before, the induction and maintenance mainly on ether having been effected most smoothly by the anaesthetist. The nut was removed through a longitudinal incision of the bronchus immediately proximal to it. A small amount of secretion was sucked away and the bronchus was closed with a few interrupted sutures of merseline. The chest was closed with underwater seal drainage.

From the chest point of view the child made a good recovery, but he remained comatose. He survived in this state about five weeks before he died.

DISCUSSION

Prevention is better than cure. Inhalation hazards associated with operations on the upper air and food passages have largely been eliminated by the use of the cuffed endotracheal anaesthetic tube. It was interesting to note the alacrity with which old pieces of rubber tubing were replaced with new pieces of sufficient length to have a firm grip on the gag, when the findings in case 3 were known.

The most important factor in the failure to diagnose the presence of a foreign body is the failure to think of the possibility, a point stressed by previous writers. Linton (1957) recorded that only five out of 16 patients volunteered a history of having inhaled a foreign body, but five more recalled the incident after it had been removed. It seems that questioning along the right lines would produce answers at least suggestive of the true state of affairs not infrequently. In case 4 a grandparent recollected that two years previously the child had 'swallowed' something once it was established that there was a screw in the lung.

Another instance was that of a man aged 50 years who had a 'pneumonia' in September and another attack in November when carcinoma was suspected and he came for bronchoscopy. He had no carcinoma but there was a peanut in the right lower lobe bronchus. He had no difficulty in recollecting when it had gone 'the wrong way' at a cocktail party in August. Another cause of failure to diagnose is too much reliance on radiographs. A small opaque body may be missed and a non-opaque body may remain in a bronchus for a long time before it causes damage which will produce radiological shadows. These are well-known facts but sometimes they are not stressed enough, and on occasion one has encountered resistance to a bronchoscopy on the part of patient or parent once it is known that the radiograph is clear. A child of 2 years was referred because she had an attack of coughing and for a while had been cyanosed after eating a peanut earlier in the day. When seen she appeared well but there was diminution of air entry on the left side. The radiograph was clear. As the child had only been referred for a radiograph the mother was reluctant to agree to a bronchoscopy; however she was persuaded that it was necessary, and a peanut was removed from the left main bronchus.

Occasionally a foreign body may present exceptional difficulties in diagnosis, as in case 3. Had a foreign body been considered when the patient first had chest symptoms, she would have been bronchoscoped and it is probable that all her subsequent troubles would have been avoided; if a patient has been unconscious, no matter for what cause, it is an added reason for considering the possibility of a foreign body. In this case it was a radiotranslucent tube which allowed bronchial filling with a contrast medium to demonstrate minimal bronchiectatic changes that could have been and were considered sufficient to account for the patient's symptoms—an unusually confusing set of circumstances.

Difficulties in removal may be due to several factors. The skill and experience of the operator and having the appropriate instruments are of importance. It is equally obvious that while most foreign bodies are readily grasped and removed, others, by reason of shape, size or consistency, may pose a special problem. In infants and small children where manipulations have to be done through a small bronchoscope, considerable skill, and sometimes perhaps a little luck, may be required; the margin between success and failure, possibly catastrophic, is slim.

Two cases are recorded in this paper in which the foreign body was removed via a bronchotomy. I believe that on occasion it is easier and safer to remove a foreign body in this way than endoscopically, particularly in infants and small children. The whole of the posterior aspect of the bronchus from the carina to the origin of the apical segmental bronchus to the lower lobe is readily accessible on both sides. After removal of the foreign body retained secretions can be milked out and sucked away. Accurate closure of the bronchial incision is important to avoid future distortion or stenosis.

Case 8 records the death of an infant after cardiac arrest during two attempts to remove a peanut endoscopically. At the third attempt, when the nut was removed via bronchotomy, there was never any anxiety concerning cardiac action. The colour was good throughout the operation and the heart action was strong. In seeking an explanation of this puzzling feature, the instruments used were examined. I believe the answer lies in the type of bronchoscope used; on both occasions this was of the type designed for the introduction of endobronchial anaesthetic tubes under direct vision. Those who are familiar with the instrument will know that it is a bronchoscope with a diameter small enough to be passed through the glottis of a small child or infant, but that it has no side vents, since these are unnecessary for the purpose for which it was designed. Foreign bodies have been removed on many occasions using these instruments, particularly in children, as there must be many hospitals that do not have a full range of child and infant bronchoscopes. If removal is effected quickly all will be well, but if there is difficulty, prolonging the procedure, hypoxia will occur. If a tube without side vents is passed through a glottis just large enough to take it and is then passed on until it is arrested by 'plugging' a bronchus, it will be appreciated that if the bronchus distal to it is blocked, the respiratory system will be 'corked off'.

Difficulties in treatment also occurred in case

5. The problem here was of multiple fragments of a particularly irritating type of foreign body. We were fortunate to find what was apparently the final piece of peanut, but it is never wise to assume that the foreign body removed is the only one present. On another occasion three almond nuts were removed, and in case 1 there were two bits of toy soldier.

During endoscopic removal the foreign body may slip out of the grip of the forceps. This potentially dangerous accident is most likely to happen when the foreign body is too large to be withdrawn through the bronchoscope and usually occurs as it is being withdrawn through the cords. Chevalier Jackson taught the importance of holding the foreign body firmly against the end of the bronchoscope so that the cords could not slip in between. It is also of help to have a well-oxygenated patient with relaxed cords before attempting withdrawal. This may not be easy to obtain. While the skill of the operator is important the same applies to the anaesthetist, and on occasion it will be paramount, his task being more difficult than that of the surgeon.

SUMMARY

In the belief that the mortality arising from the inhalation of foreign bodies may be higher than need be and that the morbidity is unquestionably so, and that the reporting of cases thought to be unusual or in which difficulties arose may be helpful to others, eight cases of intrabronchial foreign bodies are recorded. These are discussed, and in the discussion other cases are referred to in order to illustrate the points made.

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